AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1-3 (Cancelled)

4. (Currently amended) ~~The apparatus of Claim 3 wherein:~~ A valve lash adjustment apparatus comprising:

a valve lash lock nut-driving system movable in a valve lash lock nut tightening direction and an opposite valve lash lock nut loosening direction;

a valve lash adjusting screw-driving system operable in a valve lash adjusting screw advancing direction and a valve lash adjusting screw retracting direction;

at least one sensor operable to sense a value indicative of valve opening movement;

a controller connected to the valve lash lock nut-driving system, the valve lash adjusting screw-driving system and the sensor;

the controller being operable to automatically move the valve lash lock nut-driving system and the valve lash adjusting screw-driving system until a desired valve lash gap is set without requiring the systems to set a valve lash adjusting screw to an initialized and true zero valve lash position;

a rotatable rocker arm;

a threaded valve lash adjusting screw coupled to the rocker arm;

a valve lash lock nut coupled to the valve lash adjusting screw, longitudinal positioning of the valve lash lock nut relative to the valve lash adjusting screw operably setting a valve lash gap of the rocker arm;

wherein firstly, the valve lash lock nut-driving system automatically rotates in the valve lash lock nut tightening direction to engage the valve lash lock nut;

the valve lash lock nut-driving system thereafter continues rotating the valve lash lock nut in the valve lash lock nut tightening direction;

secondly, the valve lash adjusting screw-driving system is automatically rotated in the valve lash adjusting screw advancing direction;

thirdly, the valve lash adjusting screw-driving system substantially prevents the valve lash adjusting screw from rotating while the valve lash lock nut-driving system is rotated in loosening direction to back off the valve lash lock nut from the valve lash adjusting screw; and

fourthly, the valve lash adjusting screw-driving system is subsequently rotated in the valve lash adjusting screw advancing direction while the controller monitors the applied torque and angle of rotation and causes the valve lash adjusting screw to be moved a desired distance displacement, as measured by the sensor.

5. The apparatus of Claim 4 wherein:

fifthly, the valve lash adjusting screw-driving system thereafter substantially prevents the valve lash adjusting screw from rotating while the valve lash lock nut-driving system rotates in a tightening direction;

sixthly, the valve lash adjusting screw-driving system subsequently rotates the valve lash adjusting screw in the retracting direction to substantially eliminate rotary coupling gap between the driving system and the valve lash adjusting screw; and

the controller monitors the torque of the valve lash adjusting screw-driving system as it rotates in its retracting direction in order to determine when the rotary coupling gap has been eliminated.

6. The apparatus of Claim 4 wherein:

fifthly, the valve lash adjusting screw-driving system thereafter substantially prevents the valve lash adjusting screw from rotating while the valve nut-driving system rotates in the loosening direction to further back off the nut from the valve lash adjusting screw;

sixthly, the valve lash is subsequently set by the valve lash adjusting screw-driving system rotating the valve lash adjusting screw in the retracting direction a desired amount determined by the controller based upon an input signal corresponding to at least one of: (a) the amount of valve lash adjusting screw-driving system rotation; (b) the sensor which is monitored to verify that the appropriate lash has been set by the angle rotation after the knee in a curve generated by applied torque and angle of rotation; and (c) by monitored displacement and angle of rotation; has been detected; and

the valve lash adjusting screw-driving system thereafter substantially prevents the valve lash adjusting screw from rotating while the valve lash lock nut-driving system rotates the valve lash lock nut on the valve lash adjusting screw in the tightening direction.

7. (Currently amended) ~~The apparatus of Claim 3 wherein:~~ A valve lash adjustment apparatus comprising:

a valve lash lock nut-driving system movable in a valve lash lock nut tightening direction and an opposite valve lash lock nut loosening direction;

a valve lash adjusting screw-driving system operable in a valve lash adjusting screw advancing direction and a valve lash adjusting screw retracting direction;

at least one sensor operable to sense a value indicative of valve opening movement;

a controller connected to the valve lash lock nut-driving system, the valve lash adjusting screw-driving system and the sensor;

the controller being operable to automatically move the valve lash lock nut-driving system and the valve lash adjusting screw-driving system until a desired valve lash gap is set without requiring the systems to set a valve lash adjusting screw to an initialized and true zero valve lash position;

a rotatable rocker arm;

a threaded valve lash adjusting screw coupled to the rocker arm;

a valve lash lock nut coupled to the valve lash adjusting screw, longitudinal positioning of the valve lash lock nut relative to the valve lash adjusting screw operably setting a valve lash gap of the rocker arm;

wherein firstly, the valve lash lock nut-driving system automatically rotates in the valve lash lock nut tightening direction to engage the valve lash lock nut;

the valve lash lock nut-driving system thereafter continues rotating the valve lash lock nut in the valve lash lock nut tightening direction;

secondly, the valve lash adjusting screw-driving system is automatically rotated in the valve lash adjusting screw advancing direction;

thirdly, the valve lash adjusting screw-driving system substantially prevents the valve lash adjusting screw from rotating while the valve nut-driving system is rotated in the lock nut loosening direction to back off the lock nut from the valve lash adjusting screw; and

fourthly, the valve lash adjusting screw-driving system is subsequently rotated in the valve lash adjusting screw advancing direction while the controller monitors the applied torque and angle, and causes the valve lash adjusting screw to be moved a desired amount by an angle of rotation from a torque threshold valve, as measured by a torque sensor associated with the valve lash adjusting screw-driving system.

8. (Currently amended) The apparatus of Claim [[1]] 4 wherein the controller automatically inspects the valve lash setting to determine if a desired valve lash value has been obtained through prior automatic adjustment.

9. The apparatus of Claim 8 wherein the controller automatically causes selective rotation of the valve lash lock nut-driving system and the valve lash adjusting screw-driving system in order to readjust the valve lash setting if the controller determines that the lash verification measurement is undesirable.

10. The apparatus of Claim 9 wherein the controller automatically sends an error signal and stops setting the valve lash if multiple valve lash adjustments and verification determinations are performed, and the valve lash adjustment continues to be unacceptable.

11. (Currently amended) ~~The apparatus of Claim 1~~ A valve lash adjustment apparatus comprising:

a valve lash lock nut-driving system movable in a valve lash lock nut tightening direction and an opposite valve lash lock nut loosening direction;

a valve lash adjusting screw-driving system operable in a valve lash adjusting screw advancing direction and a valve lash adjusting screw retracting direction;

at least one sensor operable to sense a value indicative of valve opening movement;

a controller connected to the valve lash lock nut-driving system, the valve lash adjusting screw-driving system and the sensor; and

the controller being operable to automatically move the valve lash lock nut-driving system and the valve lash adjusting screw-driving system until a desired valve lash gap is set without requiring the systems to set a valve lash adjusting screw to an initialized and true zero valve lash position, wherein the controller causes selective actuation of the valve lash lock nut-driving system and valve lash adjusting screw-driving system in order to set the desired valve lash gap based on a point of change in a resultant value which is indicative of torque versus rotational angle of at least one of the systems.

12. The apparatus of Claim 11 wherein the controller uses the point of change in the torque versus angle determination as an initialization starting point for further setting a valve lash adjusting screw to a valve operating mechanism preloaded position which is used as a starting point to then back off the valve lash adjusting screw to set valve lash.

13. (Cancelled)

14. (Currently amended) The machine of Claim [[13]] 17 wherein the controller automatically verifies the valve lash setting to determine if a desired valve lash value has been obtained through prior automatic adjustment.

15. The machine of Claim 14 wherein the controller automatically causes selective rotation of the fastener-driver and the member-driver in order to readjust the valve lash setting if the controller determines that the verification calculation is undesirable.

16. The machine of Claim 15 wherein the controller automatically sends an error signal and stops setting the valve lash if multiple valve lash settings and verification determinations are performed and the valve lash adjustment continues to be unacceptable.

17. (Currently amended) ~~The machine of Claim 13~~ A machine comprising:

a valve lash fastener-driver;

a valve lash adjusting member-driver;

a valve lash measurer; and

a controller connected to and operably controlling movement of the fastener-driver, member-driver and valve lash measurer;

the controller operably adjusting valve lash by selectively energizing and deenergizing the fastener-driver and member-driver; and

the controller operably verifying the actually adjusted valve lash in an automatic manner based at least in part on the valve lash measurer output signal, wherein the controller causes selective actuation of the fastener-driver and member-driver in order to set the desired valve gap based on a point of change in at least the sensed value which is indicative of torque versus rotational angle of at least one of the systems.

18. The machine of Claim 17 wherein the controller uses the point of inflection in the torque versus angle determination as an initialization starting point for further setting a valve lash adjusting screw to a valve actuating mechanism preloaded position which is used as a starting point to then back off the valve lash adjusting screw to a valve lash setting.

19. (Cancelled)

20. (Currently amended) ~~The machine of Claim 19 wherein:~~ A machine comprising:

a valve lash fastener-driver;

a valve lash adjusting member-driver;

a valve lash measurer; and

a controller connected to and operably controlling movement of the fastener-driver, member-driver and valve lash measurer;

the controller operably adjusting valve lash by selectively energizing and deenergizing the fastener-driver and member-driver;

the controller operably verifying the actually adjusted valve lash in an automatic manner based at least in part on the valve lash measurer output signal;

a probe operably contacting at least one of: a valve assembly component and a rocker arm;

an automatically actuated plunger operably moving the rocker arm in a direction toward a valve stem;

a valve lash measurer operably sensing distance displacement of the rocker arm through the probe;

wherein the member-driver is a valve lash adjusting screw-driver which further comprises a first electric motor, a rotatable inner spindle and a valve lash adjusting screw bit;

the fastener-driver is a valve lash lock nut-driver which further comprises a second electric motor, a gear set, a rotatable outer spindle and a nut-receiving socket concentric with the bit; and

in at least one operating condition, the probe and the plunger are automatically movable toward an engine cylinder head concurrently with and within 45° of the same advancing direction as the valve lash adjusting screw-driver and the valve lash lock nut-driver.

21. (Currently amended) The machine of Claim [[13]] 20 wherein the valve lash measurer ascertains valve lash gap displacement.

22 - 31 (Cancelled)

32. (Currently amended) ~~The apparatus of Claim 30~~ A valve lash adjustment apparatus comprising:

a tool comprising a first automatic rotator and a second automatic rotator selectively energizable to set valve lash;

a verifier operable to verify the actual valve lash;

the verifier automatically causing selective energization of at least one of the rotators if it is determined that the verification reading is undesirable, wherein the verifier comprises an electrical controller connected to the rotators, and wherein the controller causes selective actuation of the first and second rotators in order to set the desired valve gap based on a point of sudden change in at least the sensed value readings which is indicative of torque versus rotational angle of at least one of the rotators.

33. (Currently amended) ~~The apparatus of Claim 29~~ A valve lash adjustment apparatus comprising:

a tool comprising a first automatic rotator and a second automatic rotator selectively energizable to set valve lash;

a verifier operable to verify the actual valve lash; and

the verifier automatically causing selective energization of at least one of the rotators if it is determined that the verification reading is undesirable, wherein a point of inflection in a torque versus angle determination is used as an initialization starting point for further setting a valve lash adjusting screw to a valve actuating mechanism

preloaded position which is used as a starting point to then back off the valve lash adjusting screw to a valve lash setting.

34. (Currently amended) The apparatus of Claim [[29]] 33 wherein the verifier comprises a probe operably contacting a rocker arm and an automatically actuated plunger operably moving the rocker arm in a direction toward a valve stem and a valve lash measurer operably sensing distance displacement of the rocker arm through the probe.

35. (Currently amended) ~~The apparatus of Claim 34~~ A valve lash adjustment apparatus comprising:

a tool comprising a first automatic rotator and a second automatic rotator selectively energizable to set valve lash;

a verifier operable to verify the actual valve lash; and

the verifier automatically causing selective energization of at least one of the rotators if it is determined that the verification reading is undesirable, wherein the verifier comprises a probe operably contacting a rocker arm and an automatically actuated plunger operably moving the rocker arm in a direction toward a valve stem and a valve lash measurer operably sensing distance displacement of the rocker arm through the probe, and further wherein the first rotator is a valve lash adjusting screw-driver which further comprises a first electric motor, a rotatable inner spindle and a valve lash adjusting screw bit; and

the second rotator is a valve lash lock nut-driver which further comprises a second electric motor, a gear, a rotatable outer spindle and a nut-receiving socket concentric with the bit;

in at least one operating condition, the probe and the plunger are automatically movable toward an engine cylinder head concurrently with and within 45° of the same advancing direction as the valve lash adjusting screw-driver and the valve lash lock nut-driver.

36 - 43 (Cancelled)

44. (Currently amended) A method of setting valve lash for an internal combustion engine, the method comprising:

(a) sensing values associated with valve lash adjusting screw rotation as a function of ~~at least one of: (i)~~ valve lash adjusting screw torque~~, (ii) valve displacement, and (iii) rocker arm displacement~~;

(b) inputting a precursor value based on ~~at least one of: (i)~~ a change point of at least a predetermined variation in the sensed values~~, and (ii) a predetermined threshold value~~;

(c) using the precursor value as the initialized starting point for subsequent movement setting when adjusting valve lash adjusting screw rotation; and

(d) automatically adjusting the valve lash at least in part by adjusting valve lash adjusting screw rotation.

45. The method of Claim 44 further comprising automatically verifying the actual valve lash adjustment and determining if the actual adjusted valve lash measurement is acceptable.

46. The method of Claim 45 wherein the valve lash is automatically adjusted a second time if the verified actual valve lash value is not acceptable.

47. The method of Claim 46 further comprising transmitting an error indication if the verified actual valve lash value is not acceptable after automatic readjustment a predetermined number of times.

48. (Currently amended) ~~The method of Claim 44 further comprising:~~ A method of setting valve lash for an internal combustion engine, the method comprising:

(a) sensing values associated with valve lash adjusting screw rotation as a function of at least one of: (i) valve lash adjusting screw torque, (ii) valve displacement, and (iii) rocker arm displacement;

(b) inputting a precursor value based on at least one of: (i) a change point of at least a predetermined variation in the sensed values, and (ii) a predetermined threshold value;

(c) using the precursor value as the initialized starting point for subsequent movement setting when adjusting valve lash adjusting screw rotation;

(d) automatically adjusting the valve lash at least in part by adjusting valve lash adjusting screw rotation;

~~(a)~~(e) automatically rotating a socket to rotate a valve lash lock nut;

~~(b)~~(f) automatically rotating a bit, located concentrically within the socket, to rotate a threaded valve lash adjusting screw;

~~(c)~~(g) extending a probe to contact a rocker arm spaced from a center of rotation so as to sense a displacement proportional to rocker arm motion in alignment with the valve stem axis;

~~(d)~~(h) sensing a value indicative of the interface valve lash gap between the probe and the rocker arm;

~~(e)~~(i) automatically advancing a plunger, located so as to rotate the rocker arm substantially eliminating the valve lash gap and verifying the actually adjusted valve lash; and

~~(f)~~(j) moving the socket, the bit, the probe and the plunger toward the rocker arm within 45° of the same direction.

49 - 58 (Cancelled)

59. (Currently amended) ~~The method of Claim 56 further comprising:~~ A method of setting valve lash for an internal combustion engine, the method comprising:

(a) sensing values associated with valve lash adjusting screw rotation as a function of at least one of: (i) valve lash adjusting screw torque, (ii) valve displacement, and (iii) rocker arm displacement;

(b) inputting a precursor value based on at least one of: (i) a change point of at least a predetermined variation in the sensed values, and (ii) a predetermined threshold value;

(c) using the precursor value as the initialized starting point for subsequent movement setting when adjusting valve lash adjusting screw rotation;

(d) determining if a faulty valve seating condition exists;

~~(a)~~(e) automatically rotating a socket to rotate a valve lash lock nut;

~~(b)~~(f) automatically rotating a bit, located concentrically within the socket, to rotate a threaded valve lash adjusting screw;

~~(c)~~(g) extending a probe to contact a rocker arm spaced from a center of rotation so as to sense a displacement proportional to rocker arm motion in alignment with the valve stem axis;

~~(d)~~(h) sensing a value indicative of the interface valve lash gap between the probe and the rocker arm;

~~(e)~~(i) automatically advancing a plunger, located so as to rotate the rocker arm substantially eliminating the valve lash gap and verifying the actually adjusted valve lash; and

~~(f)~~(j) moving the socket, the bit, the probe and the plunger toward the rocker arm within 45° of the same direction.

60. (Currently amended) The method of Claim [[56]] 59 wherein the faulty valve seating condition is caused by an improperly bent valve stem.

61. (Currently amended) The method of Claim [[56]] 59 further comprising sending an output signal indicative of the faulty valve seating condition different than an output signal indicative of other conditions.